

MATERIAL SAFETY DATA SHEET

SRM Supplier: National Institute of Standards and Technology
Standard Reference Materials Program
Bldg. 202 Rm. 211
Gaithersburg, Maryland 20899

SRM Number: 3151
MSDS Number: 3151
SRM Name: Silver Standard Solution
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SECTION I. MATERIAL IDENTIFICATION

Material Name: Silver Standard Solution

Description: SRM 3151 is a single element solution prepared gravimetrically to contain a nominal 10 mg/mL of silver with a nitric acid volume fraction of 10 %.

Other Designations: **Silver in Nitric Acid** (aqua fortis; hydrogen nitrate; azotic acid; engravers acid); **Silver Nitrate*** (silver (I) nitrate; silver mononitrate; argenti nitras; argerol; lapis infernalis; lunar caustic) in **Spectrometric Solution**

Name	Chemical Formula	CAS Registry Number
Nitric Acid	HNO ₃	7697-37-2
Silver Nitrate	Ag(NO ₃)	7761-88-8
Silver	Ag	7440-22-4

DOT Classification: Nitric Acid Solution, UN2031

Manufacturer/Supplier: It is available from a number of suppliers.

*The addition of silver to nitric acid, along with other intermediate chemical reactions, forms silver nitrate which will precipitate upon evaporation or drying of the solution.

SECTION II. HAZARDOUS INGREDIENTS

Hazardous Components	Nominal Concentration (%)	Exposure Limits and Toxicity Data
Nitric Acid	10	ACGIH TLV-TWA: 2 mg/kg or 5 mg/m ³
		OSHA TLV-TWA: 2 mg/kg or 5 mg/m ³
		Human, Oral: LD _{LO} : 430 mg/kg
Silver Nitrate	1.6	ACGIH TLV-TWA: 0.01 mg/m ³
		Man, Unreported: LD _{LO} : 529 mg/kg
		Mouse, Oral: LD ₅₀ : 50 mg/kg
Silver	1	ACGIH TLV-TWA: 0.1 mg/m ³

SECTION III. PHYSICAL/CHEMICAL CHARACTERISTICS

Nitric Acid	Silver Nitrate	Silver
Appearance and Odor: a white to slightly yellow liquid that darkens to a brownish color upon aging and exposure to light; pungent odor	Appearance and Odor: colorless, odorless, large crystals or white, small crystals	Appearance and Odor: a ductile, lustrous, white solid
Relative Molecular Mass: 63.02	Relative Molecular Mass: 169.87	Relative Atomic Mass: 107.87
Density: 1.0543 g/cm ³ (10 % nitric acid)	Density: 4.35 g/cm ³	Density: 10.53 g/cm ³
Solubility in Water: soluble	Solubility in Water: soluble	Solubility in Water: insoluble
Solvent Solubility: decomposes in alcohol	Solvent Solubility: soluble in glycerol, ether and hot alcohol	Solvent Solubility: soluble in hot sulfuric acid, nitric acid, and alkali cyanide solutions

NOTE: The physical and chemical data provided are for the pure components. Physical and chemical data for this silver/nitric acid solution do not exist. The actual behavior of the solution may differ from the individual components.

SECTION IV. FIRE AND EXPLOSION HAZARD DATA

Flash Point: N/A

Method Used: N/A

Autoignition Temperature: N/A

Flammability Limits in Air (Volume %):	UPPER:	N/A
	LOWER:	N/A

Unusual Fire and Explosion Hazards: Although nitric acid does not burn, it is a powerful oxidizing agent that can react with combustible materials to cause fires.

Extinguishing Media: Use extinguishing media that is appropriate to the surrounding fire. Use a water spray to dilute nitric acid and to absorb liberated oxides of nitrogen.

Special Fire Procedures: Fire fighters should wear a self-contained breathing apparatus (SCBA) with a full face piece in the pressure demand or positive mode and other protective clothing.

SECTION V. REACTIVITY DATA

Stability: X Stable Unstable

Conditions to Avoid: Avoid contact with combustible and other incompatible materials.

Incompatibility (Materials to Avoid): Keep nitric acid away from organic materials, plastics, rubber, and some forms of coatings. Nitric acid is incompatible with chlorine and metal ferrocyanide. Silver nitrate should be kept from ammonia, strong bases, alcohols, magnesium, calcium carbide, charcoal, ammonium hydroxide, ethanol, chlorine trifluoride, magnesium, phosphine, phosphorus, acrylonitrile, sulfur, phosphonium iodide, and acetylene.

See Section IV: *Unusual Fire and Explosion Hazards*

Hazardous Decomposition or Byproducts: Hazardous decomposition of nitric acid and/or silver nitrate can produce various nitrogen oxides, including nitric oxide (NO), nitrogen dioxide (NO₂), nitrous oxide (N₂O), as well as nitric acid mist or vapor. Thermal decomposition of silver may release toxic and/or hazardous gases.

Hazardous Polymerization: _____ Will Occur X Will Not Occur

SECTION VI. HEALTH HAZARD DATA

Route of Entry: X Inhalation X Skin X Ingestion

Health Hazards (Acute and Chronic): Nitric Acid: Nitric acid may be fatal if inhaled, swallowed, or absorbed through the skin. This material causes burns and is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may be fatal as a result of spasm, inflammation, and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Silver and Silver Nitrate: Silver nitrate may be fatal if inhaled, swallowed, or absorbed through skin. It is extremely destructive to tissue of the skin, eyes, mucous membranes, and upper respiratory tract. Inhalation may be fatal as a result of spasm, inflammation and edema of the larynx and bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Silver and silver nitrate may cause argyria (a state gray or bluish discoloration of the skin and deep tissues due to the deposit of insoluble albuminate of silver).

Medical Conditions Generally Aggravated by Exposure: Nitric Acid: eye disorders, skin disorders, respiratory disorders, and allergies

Listed as a Carcinogen/Potential Carcinogen:

	Yes	No
In the National Toxicology Program (NTP) Report on Carcinogens	_____	<u> X </u>
In the International Agency for Research on Cancer (IARC) Monographs	_____	<u> X </u>
By the Occupational Safety and Health Administration (OSHA)	_____	<u> X </u>

EMERGENCY AND FIRST AID PROCEDURES :

Skin Contact: Remove contaminated shoes and clothing. Rinse affected area with large amounts of water followed by washing the area with soap and water. Watch for chemical irritations and treat them accordingly. Obtain medical assistance if necessary.

Eye Contact: Immediately flush eyes, including under the eyelids, with copious amounts of water for at least 15 min. Obtain medical assistance.

Inhalation: If inhaled, move the victim to fresh air. If breathing is difficult, give oxygen; if the victim is not breathing, give artificial respiration. Obtain medical assistance if necessary.

Ingestion: If ingestion occurs, wash out mouth with water. **DO NOT** induce vomiting. If the exposed person is responsive, give one or two glasses of milk or water to drink. Obtain medical assistance immediately.

NOTE (Nitric Acid): Wash affected skin areas with 5 % solution of sodium bicarbonate (NaHCO₃). If ingested, the risk versus the benefit of the passage of a naso-gastric tube is debatable. Activated charcoal is of no value. **DO NOT** give the exposed person bicarbonate to neutralize the material.

TARGET ORGAN(S) OF ATTACK: **Nitric Acid:** skin, teeth, eyes, and upper respiratory tract
Silver and Silver Nitrate: eyes, skin, mucous membranes, fingernails

SECTION VII. PRECAUTIONS FOR SAFE HANDLING AND USE

Steps to be Taken in Case Material Is Released or Spilled: Notify safety personnel of spills. Surfaces contaminated with spills should be covered with soda ash or sodium bicarbonate to neutralize the acid. Place the neutralized material into containers suitable for eventual disposal, reclamation, or destruction.

Waste Disposal: Follow all federal, state, and local laws governing disposal.

Handling and Storage: Provide general and local explosion proof ventilation systems to maintain airborne concentrations below the TLV. Provide approved respiratory apparatus for nonroutine or emergency use. Use an approved filter and vapor respirator when the vapor or mist concentrations are high. Wear gloves and chemical safety glasses where contact with the liquid or high vapor concentrations may occur. An eye wash station and washing facilities should be readily available near handling and use areas. Wash exposed skin areas several times a day with soap and warm water.

NOTE: Contact lenses pose a special problem; soft lenses may absorb irritants and all lenses concentrate them. **DO NOT** wear contact lenses in the laboratory.

Store this material at room temperature. It must be protected from moisture.

SECTION VIII. SOURCE DATA/OTHER COMMENTS

Sources: MDL Information Systems, Inc., MSDS *Silver*, 21 March 2000.
MDL Information Systems, Inc., MSDS *Silver Nitrate*, 21 March 2000.
MDL Information Systems, Inc., MSDS *Nitric Acid*, 21 March 2000.
The Merck Index, 11th Ed., 1989.
Sigma-Aldrich Library of Chemical Safety Data, Ed. II, 1988.

Disclaimer: Physical and chemical data contained in this MSDS are provided only for use in assessing the hazardous nature of the material. The MSDS was prepared carefully, using current references; however, NIST does not certify the data on the MSDS. The certified value for this material is given on the NIST Certificate of Analysis.